ANTHONY'S PHOTO SERIES, No. 33.

CARBON PRINTING,

CONTAINING

EXPLICIT INSTRUCTIONS

FOR

PROFESSIONAL AND AMATEUR PHOTOGRAPHERS,

BY

MAX BÖLTE.

New York:
E. & H. T. ANTHONY & CO.,
No. 591 BROADWAY.
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THE matter to be found in the following pages, from the hand of one so well versed in the practical workings of this branch of the photographic art as the author, will, we think, be sought for by the many who are devoting a portion of their study and experiment to this phase of it, and we have therefore reprinted it from the "Bulletin," where it appeared as a serial, and send it forth in book form, with the hope that it may be of service to many.

THE PUBLISHERS.

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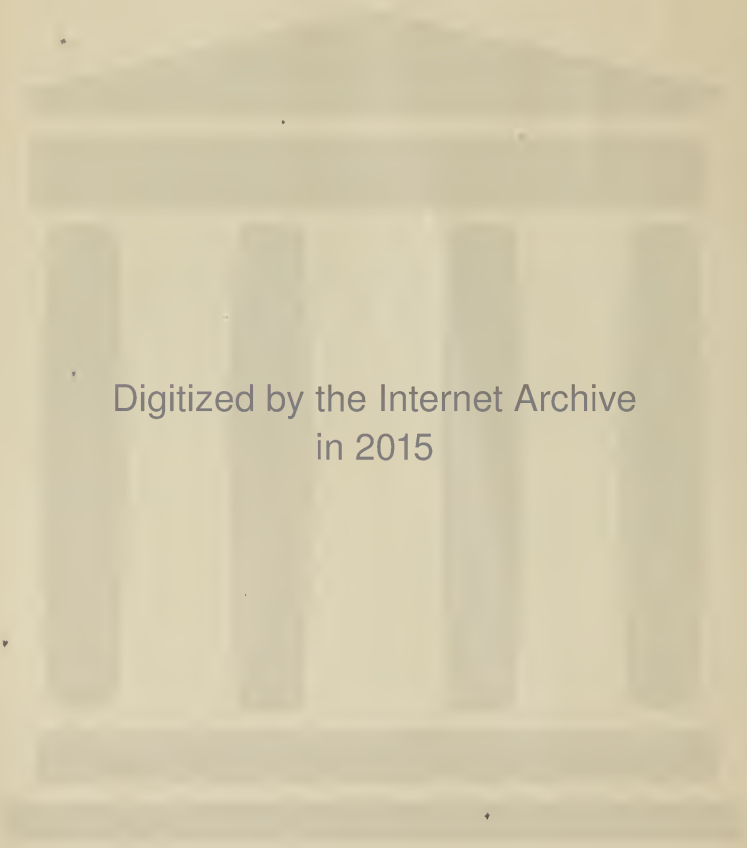


CARBON PRINTING:

EXPLICIT INSTRUCTIONS FOR PROFESSIONAL AND AMATEUR PHOTOGRAPHERS.

BY MAX BOLTE.

CHAPTER I.

Introduction.

Of all materials known to chemistry, carbon is the most constant and resistant to the influences of temperature and the hygrometric changes of the atmosphere. Looking at old manuscripts, or old engravings, which were produced by writing or printing in carbon, we always find that the black characters and lines remain black, even if centuries have passed over them, the paper, parchment, or other supporting materials, meanwhile having faded or become yellow. Carbon having been employed as the essential coloring matter in all these, it has proved to be the desideratum for the production of photographic pictures. Even if the printing processes with silver salts have advanced much, it is well known that pictures produced in this way (and having been made with the utmost care) generally fade more or less in the course of years, even if they are protected against the light.

The strain laid upon photographers in consequence of competition, often, unfortunately, causes them not to be so careful and cautious as they ought and would like to be in the production of pictures; and, owing to these and other circumstances, it only too often happens that silver prints made by them sooner or later show signs of alteration. This is due to lack of care, to which they had to consent in order to make their business pay. Of course this is not always the case, for there are, fortunately, many photographers who, by their merits and conscientiousness, are in such a position as to be able to devote all their time and a special carefulness to the production of as really good and permanent work as possible, in order to maintain the high standing which they have been able to reach through their ability and the artistic class of work they turn out.

Now, as regards the carbon process there is the great truth which predominates over all, viz., that carbon pictures produced in the way already described by many authors, and practiced by a great number of well-known photographers and amateurs, are stable and not subject to any such influences as are dangerous to silver prints. There has often been made the apparently just remark by those who do not know the carbon process, that it is a so-called "blind" process, *i.e.*, it is in some way guess-work, or a process where the watching of the impression produced by the light on the sensible pigment cannot be seen, controlled, and modified. It has further been objected to this beautiful and interesting process, that it is too delicate and claims too much care and constant precautions in order to produce good prints.

But all these objections are made in a somewhat rash and inconsiderate manner, for science and intelligence have given us an auxiliary which, as far as caution and carefulness come into co-operation, supplies us with a contrivance

more perspicacious than our own eye would be: the photometer or actinometer, which was invented expressly for this purpose. By means of this little contrivance, carbon printing is rendered really easy, and the worker readily becomes acquainted with its use, and soon acquires a security which in fact is surprising.

As far as precautions and carefulness are concerned, it is evident that any such process will claim its just portion; but considering that the silver printing process also claims them (the repeated washings of the prints, the gold toning bath, the elimination of the hypo, etc.), it is evident that the balance inclines towards the carbon process, so long as really permanent prints are desired.

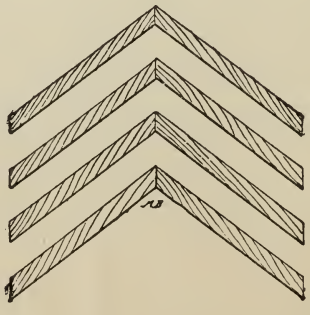
The carbon process since it was invented has always been an interesting subject to scientific men, and when we look over its history we find the names of Poitevin, Regnault, Sutton, John Pouncy, Fargier, Swan, I. R. Johnson, Leon Vidal, Dr. Van Monckhoven, Bolas, Woodbury, Dr. Liesegang and others, who have all worked and made improvements upon it. Several treatises have been published, all containing valuable formulas and recommendations, but very few are written in such a detailed way as to enable a person to take up the carbon process and, book in hand, make it a success. The principal object of the present treatise is to enable any person to become a carbon printer, and special care has been taken to give all the instructions as clearly as possible; giving the formulas for the sensitizing baths, solutions, etc., plain and intelligible, in order to avoid to the utmost the chances of a bad result; and it is hoped in a manner that will enable any careful worker to follow up this process with not more trouble than attaches to any work of a similar kind.

CHAPTER II.

Work-rooms.

A dark room (yellow glass windows or yellow artificial light are sufficient) must be provided wherein to sensitize the carbon paper, and special care must be taken that it is well ventilated and not in too close proximity to a kitchen, stable, or water-closet. It is also necessary that it is a dry room, and that the floor be clean and not covered with a carpet. The screens for keeping off the actinic

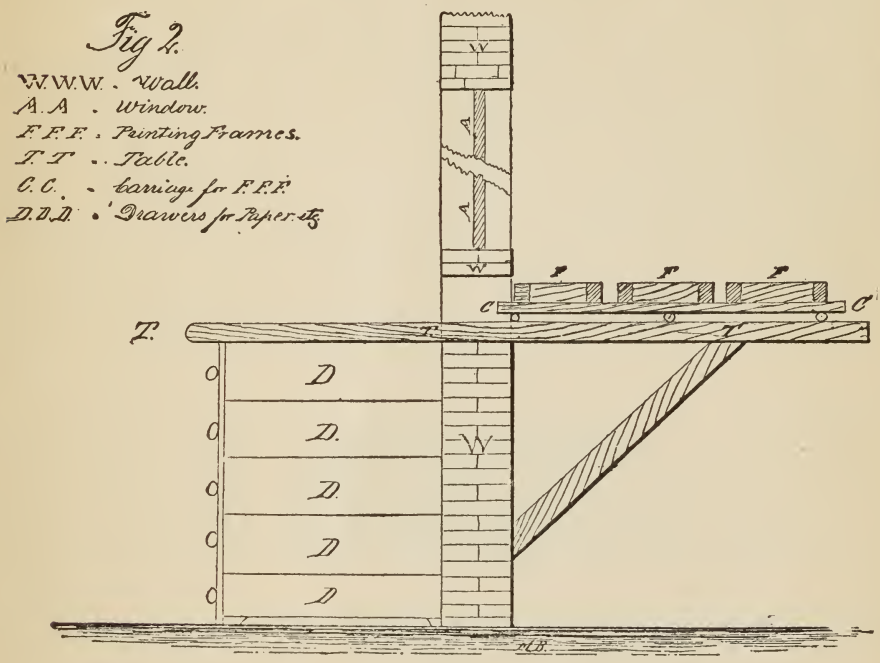
Fig. 1.



light ought by preference to be of dark smoked orange glass, combined with yellow (sunflower-color) tissue paper when it is the intention to sensitize during

the daytime. However, as will be seen in the Chapter on Sensitizing, it is not absolutely necessary to sensitize during the day, and it is even more convenient to do it in the evening, when a simple sperm candle is all that is wanted to conduct these operations.

For the production of large quantities of carbon prints on a large scale, there should be a dark room as described above. The late Dr. Van Monckhoven recommended a special contrivance, which at the same time gives a good and abundant light with perfect and convenient ventilation. It consists of



double shutters, as in Fig. 1, painted inside and out with a yellow color, and having the angle uppermost. A window may be fitted to receive it. Mr. Sarony, of Scarborough, England, uses a very convenient arrangement, which will be easily understood by Fig. 2.

The rooms for development, mounting and retouching do not claim any special preparations as regards light, for all these operations are conducted in daylight. There should, however, be provided communications with the main water-pipe and sink. It is good if the floor is covered with asphaltum, or has stone paving.

For amateurs these contrivances are not necessary, or should be greatly modified. The greater number are possessed of a dark room, and will easily be able to make such alterations as will be indicated hereafter. The above recommendations as regards light, ventilation, proximity of kitchens, stables or water-closets, etc., must be borne in mind. Those, who do not possess a dark room will also be able to make carbon prints if they follow the indications given in the following pages.

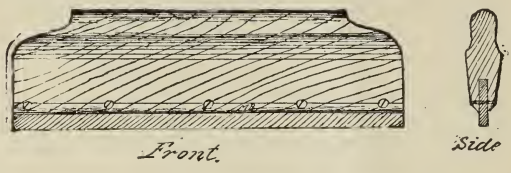
CHAPTER III.

Apparatus.

Trays.—Four different classes of trays are wanted: for sensitizing, a reservoir tray, developing, and alum bath. Their size depends upon that of the plates used and the dimensions of the pictures desired. For 8 x 10 plates the dimensions of the trays ought to be as follows: Length, 11½ to 12 inches, breadth, 9½ to 10 inches, depth, 5 to 6 inches. For sensitizing and developing same length and breadth, but at least 10½ inches deep for the reservoir tray, and only 2 to 2½ inches for the alum bath. The 8 x 10 size for plates is very convenient, for it allows that two 5 x 8 or smaller sized pictures can be developed at the same time, thus simplifying the work very much. These trays should be made of stout sheet zinc, not of tinned iron. It is also very convenient to procure one larger tray, two to three inches longer and broader, and to use it, when the temperature in summer rises above 70 to 75 degrees F., as a cooling-bath for the sensitizing and transfer manipulations. If convenient, all these trays may be coated with a varnish made of asphaltum in benzine; however, it is not necessary.

Squeegee.—There should be at least two squeegees. They can be obtained ready made and of different sizes. It is easy to make them by proceeding as follows: Take a piece of wood say 8 by 3 by ¾ inches, and give it the form as in Fig. 3. Make a groove at the lower end, and place into it a piece of rubber-

Fig. 3.



cloth, three or four-ply, the same length as the wood and about two inches in breadth; secure by means of some brass screws. Larger plates than 10 x 12 claim a squeegee of larger size. Mark one of them with a *B* and the other with a *T*, and use *B* only for the sensitizing of the paper and *T* for the transfers, as will be explained later on.

India-rubber Cloth.—Two pieces of this cloth should be provided. As regards size, they must be at least three inches larger every way than the plates for which they will be used. They must be kept clean, and it is best to use one for the sensitizing and provide it with a mark, say *B*, and reserve the other for the transfer, marking it *T*.

Folding Racks.—There should be three. They are cheap and can be obtained from any dealer in photographic materials.

Glass or Porcelain Plates.—These plates must be chosen according to the size of the pictures to be produced. It is also left open to decide whether ground or plain plates shall be used. Plain plates, glass or porcelain, produce pictures (by means of the double transfer) with a high gloss; ground plates give a matt surface. Beginners will do better in employing porcelain plates, which render it more easy to estimate the strength of the picture when developing. Large pictures, also transparencies, claim glass plates, for there is a difficulty to obtain large porcelain plates free from defects, and their cost is exceedingly high.

Transparencies cannot be estimated sharply as regards their degree of development if they have been transferred to porcelain.

Collodion Bottle.—Cross' filtering and pouring bottle is a very convenient contrivance. It has the advantage that it is cheap and very handy, as no collodion but that which passes through the filter comes into use.

Funnels.—There ought to be two funnels, either glass or india rubber, and of convenient size, one to be used for sensitizing and the other for the alum bath; and, in order to avoid confusion, they should be marked, the former *B*, and the latter *A*, and should *only* be employed for the designed purpose.

Thermometer.—Either a so-called bath thermometer, or one mounted on glass, and with divisions in Fahrenheit and centigrade degrees is necessary.

Heating contrivances.—For large quantities of work a so-called "Geyser" is recommended. It consists of a cylinder containing a spiral coil, and having an opening at the top for connection with the water-pipe, and a valve at the lower end. Underneath is a gas-burner. It heats the water very fast, and by regulating the burner and the valve of the water supply, any degree of heat can be given to the water. Amateurs will not require such an apparatus, as they will not want large quantities of hot water. It will be sufficient to procure a good single or double-wick "Summer Queen" kerosene stove and a water-kettle of convenient size. It is an absolute necessity to have a contrivance for heating water, for without hot water nothing can be done. The kettle should hold at least half a gallon; of course all depends on the scale of the work to be done.

Large establishments may be fitted out with some developing and washing trays of large dimensions; the former resting on a sort of cradle and being suspended at the center, are movable in the same manner as a see-saw. The water supplies, cold and hot, should be placed over them, and there may be also provided some roses, which are very useful to give a final wash to the plates; or, the roses from the hot water supply are used to clear up darker portions of the picture under development.

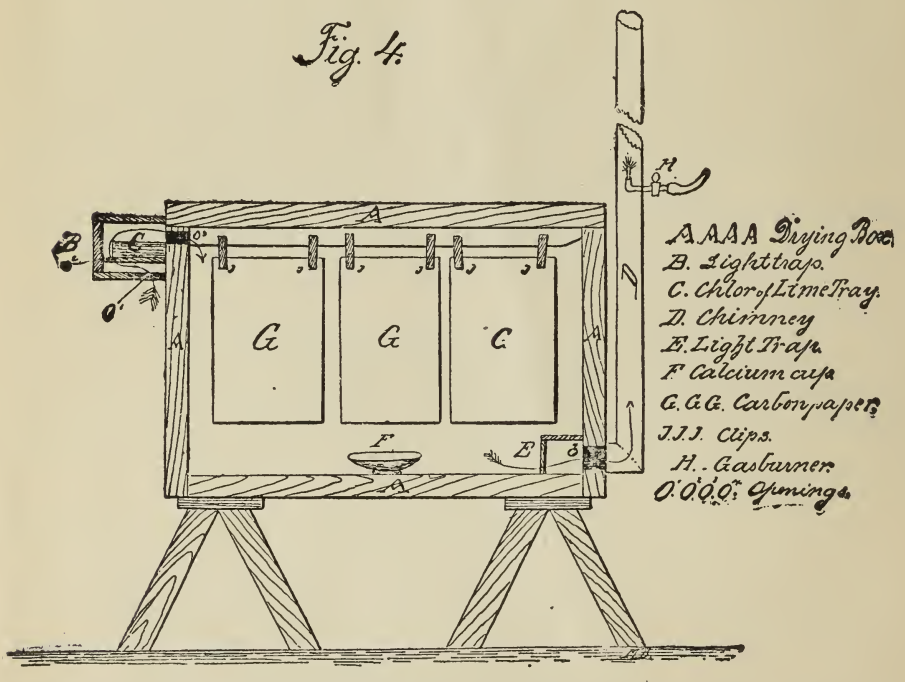
Printing Frames.—The same class of printing frames as are generally employed for silver prints may be used. There are however others made expressly for this process and which have no folding back, since there is no necessity to open the frames during the exposure to the light in order to see the progress made. The frames must be kept free from dust and as dry as possible. It is good to cut some pieces of impermeable paper or of rubber-cloth and lay between the tissue-paper and the back plate of the printing frame. These pieces should be a little larger than the carbon tissue. Very handy and convenient are the printing presses invented by Mr. Sarony; they are too well known to require describing here.

Wood Clips—About two dozen or more are wanted. They are cheap. The most convenient are those that have a hook on the upper end, by which they may be suspended on a rope or wire.

Drying Box.—For those who cannot arrange a special room (well ventilated, dry, and not in too close proximity to a kitchen, stable, etc., as mentioned already), a contrivance like this will enable them to take up this fine process. A somewhat detailed description and illustration are necessary (see Fig. 4). The box, *A A A A*, should have the following dimensions: Length, 3 to $3\frac{1}{2}$ feet, breadth, $2\frac{1}{4}$ to $2\frac{1}{2}$ feet, height, $2\frac{1}{4}$ to $2\frac{1}{2}$ feet. The boards ought to be one inch in thickness, well joined, and, of course, perfectly light-tight. A door must be provided opening the whole length, and fitting perfectly light-tight also. At one end of

the case, as near as possible to the top, make an opening, O^3, say $\frac{3}{4}$ inch by 2 feet, parallel with the top, and place before it a light-trap, *B*, as indicated in Fig. 4. This trap can easily be made by any one who possesses a pocket-knife, some nails, and a glue-pot. The arrow in the drawing indicates the course of the air (passing through openings O^1, O^2 and O^3, which are all three of same length and breadth), and the black spots show where the openings should be made. There must be provided a board on which the zinc tray *C*, can rest, which must be filled with chloride of lime. A door must also be made by which this tray may be introduced and withdrawn, of course also light-tight. As the tray is rather long, it will be best to make the door at the smaller end of the light-trap and at its front. Also make a hole, O^4, opposite and diagonally across from the former, *i.e.*, at or near the bottom of the case, ***A A A A.*** **This hole should be**

Fig. 4.



round and of 3 inches diameter. Attach to it the chimney tube, *D*. This tube must have an elbow and a perforation at the height of the top of the case or above, for the introduction of the gas-burner. If no gas can be obtained, the tube should be provided with a drum or a cone, and in it should be placed a kerosene lamp, resting on a cross-bar at about one inch from the bottom of the drum. The area of the tube should exceed that of the opening, O^3, coming from the light-trap, *B*, in order to produce a stronger draught. There should be placed a light-trap, *E*, before this outlet of the air in order to prevent any light rays proceeding from the burner in the chimney entering the case. It is sufficient to join two small boards of say 10 by 4 by $\frac{1}{8}$ inches lengthwise together and place them before the opening inside of the case. Now extend some copper wires parallel with the front side of the case and at about three inches from the top, from one side to the other, and make them equi-distant from each other. For a box of the above dimensions four or five wires will be all that is required, and will

allow of hanging upon them from sixteen to twenty pieces of carbon tissue of 8 x 10 or larger, and this quantity is sufficient for one day's work. It will dry in a corresponding time, if properly managed.

The drying box should rest on trestles eighteen inches high, as indicated in the drawing. The joints of the boards should be pasted over on the interior of the case with some stout paper strips, and the front door must of course swing outward. It is good to provide the rabbets of the door frame with some cloth strips in order to exclude any dust or light which, without this precaution, might find its way into the interior of the case. The whole contrivance ought to be kept as clean and dry as possible. It is a good plan to place some heated bricks in the box from time to time and allow them to cool off. This should be done when the weather is damp, and of course by preference before the case is to be used. In the course of this treatise we shall give some more explicit instructions for the management of the drying box.

The above mentioned accessories, with the exception of the photometer, of which a description and illustration will be furnished later, are the requisites necessary. As regards scales, measures, weights, filtering and blotting-papers, etc., these are generally at hand with any photographer or amateur.

CHAPTER IV.

Chemicals and Paper.

There are two chemicals which play an important *role* in this process. Bichromate of potash ($K_2Cr_2O_7$) and bichromate of ammonia $(NH_4)_2 Cr_2O_7$, but as there is such an extraordinary difference of price between the former and latter, without any equivalent benefit, we shall only speak of bichromate of potash. This chemical should always be handled with the greatest care, for it is strongly corrosive. Solutions of this salt taken internally cause violent inflammation of the stomach and kidneys, accompanied by severe vomiting (yellow) and diarrhœa. Bicarbonate of soda or magnesia should be taken as soon as possible. There is not much danger, since cases where mistake has led to the taking of these solutions internally are exceedingly rare. By far the greater danger lies in the handling of the cold or warm solutions, in which the carbon printer might have to immerse his fingers and hands. It should always be borne in mind that these solutions, even if employed weak and tepid or cold, cause strong irritation of the skin, and should there be any light scratches or lesions of the skin on the fingers or hands, the inevitable consequence will be an irritation of those wounds, with sometimes very disagreable consequences and rather difficult healing. We strongly recommend not to allow the fingers and hands to remain too long in the solutions. Rubber gloves should be used. The cold sensitizing baths, although stronger in bichromate, are not as dangerous as the warm, or sometimes even hot, developing bath, for as the pores of the skin open by warmth, they are more likely to absorb the poison contained in these solutions. Avoid also contact of the eyes or nostrils with the fingers which have recently touched chromic salts.

Some months after having taken up carbon printing, I was surprised to find myself with rather disagreeable sores and ulcers, which made their appearance on

my fingers and hands, and I attributed them to impurity of my blood. The physician whom I consulted admitted that he had never before seen such ulcers. Business occupations compelled me to suspend carbon printing for about two months, and the ulcers had by that time disappeared. When I again took up carbon printing, having some slight scratches on the hands which I got by playing with a cat, I noticed that they would not heal, showing much inflammation, closing at the surface and forming pus. Some dreadful ulcers appearing in much greater numbers also made their appearance, and this time they were of a far more venomous character and for weeks resisted any treatment. I decided to go to Germany and there I consulted three eminent physicians; two of them, after careful examination, came to the conclusion that my case was analogous to syphilitic disorganization. Subcutaneous injections of bichloride of mercury with a slight addition of common salt were made. One of these injections provoked an ulcer on the hip which kept me for eleven weeks in bed. Three operations were made, cutting always the borders larger and employing chloride of zinc for seventy-two hours to cauterize the bad flesh, etc. Visiting New York about a year after this experience, I learned here that the disease from which I was suffering was nothing else but bichromate of potash poisoning. The remedies given to me were sulphide of calcium (two pills of an eighth of a grain daily for one week) and phenic acid in syrup (a tablespoonful morning and evening, also for one week), and alternating these two for about six to ten months. This was in 1884, and to-day I am assured that this treatment has entirely cured me, and for more than eighteen months I have been well.

Waxing Solution.—To prepare this solution take

White (virgin) wax	1 ounce.
Benzole	100 ounces,

The wax must be scraped as fine as possible. Introduce it into a bottle, pour on the benzole and shake well until entirely dissolved. Let it stand for a couple of hours and decant the clear solution. Be sure that the bottles are absolutely clean and free from water, for the least drop would render the solution turbid. Only pure white or, still better, yellow wax, which is generally purer, must be used, for if tallow is contained in it the solution will not give the high gloss desired. If adulterated wax has been employed, an addition of one part of rosin to ten parts of wax may be used.

Collodion.—The collodion should not contain more than one per cent. of cotton and equal parts of alcohol and ether, *i.e.*, 50 parts alcohol and 50 parts ether. For those who do not know how to prepare the collodion, I will here give a convenient method. Having weighed the right quantity, open the soluble cotton and tuft it well; introduce it into a bottle somewhat larger than required, and pour on some of the alcohol. Shake well, add the remainder of the alcohol, and again shake well until you see that the cotton is perfectly soaked. Now add a small quantity of the ether and shake well; add more and shake again, and so on until all the ether has been added. Allow the collodion to stand for a couple of days, for new collodion does not work so well as old. It may be used as it is however, if desired, or, if necessary, a slight addition of carmine or aniline red may be used. These colors are first dissolved in alcohol, and of this solution the necessary quantity is added to the collodion, which after this addition is again well shaken. The collodion should either be decanted or, better still, filtered through flannel, in order to have it as clear as possible.

Alum Solution.—This is used—and cannot be dispensed with—after the development of the carbon picture, as it serves to harden the gelatine and eliminate any trace of bichromate of potash which might still be contained therein. For double transfer pictures the solution must not be stronger than 2 to 100; for single transfer it can be made as strong as 5 per cent. It is preferable to use rain water, though any water can be used, but then from three to five drops of sulphuric acid must be added in order to keep the solution clear. Before use filter repeatedly, at least three times. It is best to use always fresh solution.

Carbon Tissue Paper.—Though it is not very difficult to prepare this paper, as there are so many and reliable manufacturers who produce it in excellent quality, any desirable shade, and at not too high prices, it will be better to take advantage of their products, and save the carbon printer many an inconvenience and failure. I therefore abstain from giving a description how to prepare it, which would moreover lead to a somewhat lengthy discourse. There are however some few items which should always be borne in mind: 1st. The fresher the paper the better it will work. 2d. Always preserve the paper against dampness and emanations from kitchen, stable or privies; it is almost absolutely necessary to keep it in tin tubes or boxes, which should be as air-tight as possible. 3d. The cutting of the paper ought to be done with care, and the fingers should not touch the gelatine side, for any such touching would leave a mark and sometimes show in the picture. During hot weather linen thread gloves should be worn for this manipulation. The operation is often, especially during hot and dry weather, a somewhat tiresome one, since the paper becomes so brittle that it is scarcely manageable. It is therefore good to place it for a night in a cellar or room where some damp clothes are hung up, unroll, but not cut it until sufficiently softened. After cutting, the pieces should be kept under a weight or in a printing frame and with the carbon sides face to face.*

CHAPTER V.

Sensitizing the Tissue.

The solution should be prepared as follows:

Bichromate of potash (finely pulverized)	3 ounces.
Carbonate of ammonia	70 grains.
Water	100 ounces.

and after complete solution it should be filtered repeatedly through flannel. Never omit the carbonate of ammonia, as it much facilitates development. The solution must be used at a temperature of 58 degrees and if still cooler it will be better. It should stand at least 1½ inches in the tray, and care must be taken that the temperature *does not rise during the sensitizing*. Having dusted a piece of carbon paper on both sides immerse it in the solution, carbon side up, and for *exactly two minutes*, rocking the tray all the time, being careful that the paper remains completely covered. Any air-bells that appear must be removed by the

* Single and double transfer paper, also flexible support paper will be described later on, when speaking of their employment for their respective uses.

duster. Withdraw the paper and *immediately* reimmerse in the solution, but this time *only for one minute* and carbon side down. Pass the duster over it in all directions, that no air-bells remain adhering to it, which sometimes produce black spots in the lighter parts of the picture.* Having placed a stout glass plate, somewhat larger than the sheet sensitized, on the table, take the sheet, holding it by two opposite corners, and allow the solution to run off; and as soon as drops form, lay it, carbon side down, upon the glass plate and cover it with the rubber-cloth, glossy side up. Now take the squeegee, and by employing at first a gentle pressure squeegee it in all directions and always from the center to the edges. The rubber-cloth is now withdrawn, and by means of one or two wood clips the paper is hung up to dry, either on some wires fitted up for this purpose in the drying room or placed in the drying box. Serve all the sheets to be sensitized in the same way. The squeegeeing of the paper may be omitted if desired, but *in hot weather it must be done.* The drying is a very important item, for the time which is occupied by it has a material influence upon its after behavior; if dried too quickly the paper will be found much too brittle, will print slow, and be deficient in half tones; if too long in drying it will most likely become insoluble and useless. The right time is from six to ten hours. The sensitizing can be done in subdued daylight or, better still, in the evening, using a sperm candle, but neither kerosene or gaslight. Carbon paper when wet is not affected by light, but once *sensitized* and dry it is from *three* to *five* times more so than albumen silver paper. Proper drying imparts three qualities to the paper: 1st. Vigorous prints, clear whites or high lights, and well pronounced shadows; 2d. Easy adherence to the paper, glass, or other transfer medium; 3d. Easy and short development. Some authors have recommended to sensitize a couple of sheets at the same time, but I have found that this is not to be advocated, as there is no secure way to avoid the air-bells, which, if many sheets were sensitized together, would escape the attention of the worker, but would show when developing and not easily be removed. It is evident that the sensitizing solution, after having used it for a number of sheets, gets weaker, and it is therefore prudent to take a fresh bath after a certain number of sheets, say ten to fifteen, have been immersed. As the bichromate of potash is not an expensive chemical, there should not be a false economy with the bath, and after use the solutions should be thrown into the sink.

Regarding the management of the drying room and the drying box, I will here give some hints. The drying room should be as free from dust as possible, and be guarded against any white light, and have a good air supply. The drying box also must be dry, be well cleaned, and, before putting in the paper, the chloride of lime box should be filled about a quarter inch high and the air current established. Should there be much dampness in the air it will be found convenient to employ chloride of calcium, of which a sufficient quantity may be introduced *ad hoc*, and placed in the drying box.† It is good also to remove any vessels containing water or solutions, for their presence in the room would contribute to lengthen the drying of the paper.

Frequently the paper after a short, but good, drying becomes rather brittle

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*The paper first rolls up, but later on flattens out, and this is the right moment to withdraw it from the bath.

†From time to time, and especially when the air is humid, some heated bricks should be placed in the drying box, of course before any paper is hung up to dry.

and horny; in order to avoid this the sensitizing bath may be made up as follows:

Bichromate of potash	3 ounces.
Carbonate of ammonia	70 grains.
Water	100 ounces.

and for each quart of the solution from one-fourth to one-half dram of glycerine, but *never* more. When working in hot weather it will be found advantageous to add to the preceding formula from 90 to 100 grains of salicylic acid, and it will be found that the reticulation will be avoided.

Having sensitized in the evening, the paper will be found perfectly dry in the morning, provided that everything was all right, and it may now either be exposed to light under the negative, or placed in the preserving or magazine box. Of course these operations must be performed in non-actinic light. Paper which has been sensitized without the addition of salicylic acid cannot be kept longer than from three to five days, but those with salicylic acid will keep good, if preserved against the action of the light and air, for as long as ten to fifteen days. It is good to keep the sensitized papers in a light and air-tight box and under pressure.

CHAPTER VI.

Negatives and Printing.

The negatives which should be employed ought to be of good density and must be provided with a so-called "safe edge," *i.e.*, some opaque yellow or

Fig. 5.

Negative with Safe edge (A A A A)

black paper strips pasted around the borders. These strips ought to be from one-eighth to one-fourth of an inch wide. This is a necessity, for if there were not a safe edge many a good print might be spoiled by a little carelessness, when withdrawing the tissue paper from the transfer medium.

For double transfer the negatives as generally taken are all right, for the picture will show right, *i.e.*, the objects which are on the right side will come in the picture on the right side also; but for the single transfer the negatives must

be reversed, for this process gives pictures where the right side objects are shown on the left side. This is due to a peculiarity of the carbon process—the prints must be developed from the back. As it also reproduces in the most absolute way any shades or gradations of the negative, it is necessary when printing from thin negatives that they are covered on the glass side either by mineral paper or matt varnish. The latter is preferable, as it admits that parts which should print strong can be cleared up or scraped off. A very good formula to make the varnish is as follows:

Gum sandarac (finely powdered)	4 parts.
Ether	36 "
When dissolved add	
Canada balsam	1 part.
Benzole	20 to 30 parts.

Filter.

The greater or smaller quantity of benzole produces a coarser or finer grain. This varnish is employed on the back of the negative, which however should not be warmed. If more density is wanted a second covering with the varnish may be given. The retouching can be done with the pencil, graphite and stump, also with brush and colors, and parts which should print well may be lightened up by means of a brush dipped in mastic varnish. Larger negatives may be covered with mineral paper which was first soaked in water and blotted off. The borders only must be gummed and the whole sheet drawn as tight as possible over the plate. The retouching, by means of stump and pencil, should be done on the paper when dry. Strong negatives do not require this, but thin negatives will be much improved by it. The single transfer process requires reversed negatives, which may be made either direct in the camera, placing the film side of the plate against the holder (of course the focusing glass should be reversed also, or its thickness taken into consideration when focusing), by means of a prism placed before the lens, or by a mirror inclined 45 degrees to the axial light rays. For these two modes the exposure should be about one-fourth longer. Or reversed negatives by means of film may be used. Negatives of good density turn out powerful, rich prints; thin negatives give flat pictures. By employing weaker or stronger bichromate solutions there is a remedy, and from weak negatives strong and powerful prints may also be made and *vice versa.* Much-intensified negatives produce hard prints without any soft gradations, and such prints should be exposed, either before or after printing, for a few seconds to diffused daylight.

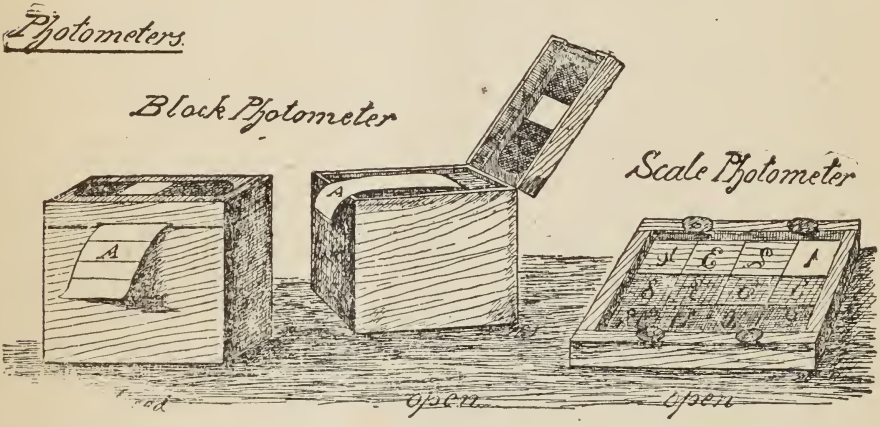
Photometer.—There are several styles, which all answer well. We shall only speak of two, the scale photometer and the block photometer. The scale photometer can be easily made by any one; it consists of a 4 x 5 glass plate, or smaller, divided into twelve, sixteen, or more squares, and formed by the superposition of pieces of mineral paper, the first square being covered with one piece, the second with two, and so on until the last, which would have twelve or sixteen pieces pasted one over the other.* A 4 x 5 printing frame is very suitable. The silvered paper is laid against the corresponding square, the frame closed and exposed to light, and when sufficiently printed the respective number will stand out white on a brownish ground. The block photometer is a small box provided with a

* When all the papers are perfectly dry there should be inscribed the numbers from 1 to 12 (inverted) either with India ink or some red color.

double cover. The upper cover has a round opening cut in it, and under it is placed a glass plate divided into three sections, of which the two outer ones are painted chocolate-brown (the tint which silvered paper shows when exposed to direct sunlight for one and one-half minutes). In the case is placed a roll of sensitized paper corresponding in breadth to that of the inner section of the glass plate, or a little larger, and of any desired length. The end of this roll is drawn over the lower cover of the box so that it stands out a little. The upper cover is now closed and the photometer exposed to the light, and as soon as the silvered paper shows the same color as the painted sections it is called *one* tint.

There is now the question how to apply the photometer to the printing. The printing frames having been provided with negatives and sensitized papers, and the photometer having a fresh portion of silvered paper under the opening men-

Fig. 6.



A Paper Strip.

tioned, are exposed together to the action of the light, and when the photometer shows the required color, the carbon paper has been acted upon by the light in the same way. How many tints, or what number of the scale photometer, requires a negative of a certain density? This question can only be answered by practice, and the beginner most assuredly will have to sacrifice some prints in order to learn how to estimate the density of the negatives in their relation to that class of photometer which he has adopted. A negative of medium density may require from three to four tints, or even more if matt varnish or some strong retouching has been resorted to. The question which photometer shall be employed should be answered first, for it is prudent to always use the same photometer, as it much facilitates the work when the printer has got well accustomed to its strength. The silvered paper for the photometer should always be of the same strength of silver, for uniformity is absolutely necessary in order to be able to rely upon the right working of all. The silvered paper is best made of Rives paper, immersed for ten minutes in a 10-grain solution of chloride of sodium, and when dry may be kept ready for use. When required, float it for two minutes on a 40-grain solution of nitrate of silver, and add about ten grains citric acid to each ounce of the solution. The sensitizing of course must be done in the dark. The paper preserves its whiteness for weeks when kept from light.

Having selected the negatives that are to be used, separate them according to their density. The printing frames must be as free from dust as possible and perfectly dry. The light should be subdued before the sensitized carbon paper is resorted to. See that the negatives are free from dust, take a piece of carbon paper, dust it well on both sides, and place it over the negative, gelatine side in contact with it. Cover with a piece of rubber-cloth or a felt pad (*must be absolutely dry*), and close the back of the printing frame. When all the frames have been filled in this way, expose to light and place the photometer close by them. Watch the photometer, and when the required tints are reached, turn those frames over which correspond. Proceed in the same way with all of them. The requisite exposure given, the printing frames are taken back to the dark room and emptied, and the printed carbon papers are now laid away in a light-tight box, and, if possible, some pressure applied to them.

Should there be some hard negatives, it is best to expose the printed carbon sheets for a few moments to daylight, which would give them a softer appearance; but care should be taken not to allow the light to act too long.

The printing for double or single transfers is exactly the same, but for transparencies a longer exposure to light is necessary.

N. B. *Care must always be taken never to employ damp tissue paper.*

Since the gelatine side of the tissue is pressed in contact with the negative, it is evident that if it retained the slightest adhesiveness on its surface it would be dangerous to press it against the negative. However there is a very efficient remedy, which was first employed by Mr. Swan; it is simply to dust the negative and the carbon paper with some steatite (French chalk or talc). Of course the dusting must be done in a careful way, and by means of a camel's hair duster as much as possible of the steatite should be removed. This imperceptible coating offers two advantages: First, it is a discoverer; for if there is any moisture left in the tissue, when passing the brush over it the steatite will adhere in patches to any moist places, and will not spread in a scarcely perceptible coating. Second, it prevents an excessive absorption of light in those parts of the carbon tissue which are in such absolute contact with the negative as to prevent the reflection from its back surface. The dusting of paper or negative, or both, does not cause any imperfection in the print.

CHAPTER VII.

Single Transfer Process.

This process is free from any difficult operations and may be described as follows:

The exposed carbon tissue, together with the single transfer paper, is placed in a tray containing water of not over 58 degrees F., and after some minutes are withdrawn together from the water, placed on a glass plate or wood board, and squeegeed together. They must now remain in contact for at least fifteen minutes, and slight pressure may be employed; placed in a tray containing lukewarm water, when the tissue paper will separate from the transfer paper, leaving the carbon on the latter, and the development is now completed. The developed picture is then placed in an alum bath for ten minutes, well washed, and hung up to dry.

Having subdued the light, a sheet of tissue is taken, dusted carefully on both sides and immersed in the water contained in the tray, which must not exceed

58 degrees F. The same is done with the transfer paper, but as many as five, or even more, may be placed in at once, for it does not make any difference if they remain some minutes more in the water. The tray containing the carbon tissue is rocked all the while, and care must be taken that no air-bubbles remain adherent to the tissue. It first curls, but must remain entirely immersed, or it might reticulate (especially during hot weather) when this precaution was not taken. After about two minutes the tissue flattens out, and *this is the very moment* to withdraw it from the water.*

The glass plate, which must be somewhat larger than the transfer paper, should be clean and free from all dust. Place the transfer paper, *glossy side up*, upon the glass plate. Lay the tissue paper, *carbon side down*, upon the transfer paper, cover with the rubber-cloth, and apply the squeegee from center to borders, first using gentle pressure, and later applying more. Now withdraw the rubber-cloth and examine, holding the papers horizontally against the light, if they have been well pressed into contact. Remove any moisture which might be present at the borders by means of a moist sponge or linen towel, and hang up to dry. As it often happens during hot weather that the carbon tissue does not properly adhere to the transfer paper, it is better to place the squeegeed papers between two glass plates and put a weight on, leaving them under pressure for 15 to 20 minutes, then suspend them to dry. Proceed with all the sensitized tissue and transfer papers in the same way, and place the second on top of the first and so on, but always cover them with a glass plate and use pressure. The same water which has served for the first tissue and transfer paper may be used for all the rest, provided that *its temperature does not rise above 58 degrees F.* The development may be made after fifteen minutes, but not sooner.

As soon as the tissue papers have been moistened, daylight may be admitted, for sensitized carbon paper is only sensitive to light when dry.

If there are small size tissue papers, as many as the transfer paper will hold may be squeegeed into contact with it, thus simplifying the developing and other operations very much.

The rubber-cloth should not be too thick, and must always be placed with its cloth side upon the paper.

The water must stand at least four inches deep in the trays; better if deeper.

N.B. *Never proceed to develop until the bichromate has entirely penetrated the transfer paper, which is easily seen by the yellowish color it assumes.*

Single Transfer Paper.—This is a water-proof paper, having on one side a bright gloss. It is made in rolls exactly like the carbon tissue, covered on one side with a gelatine layer rendered insoluble by the addition of chrome alum. It may be also made as follows: Well-sized white paper is soaked for fifteen minutes in a sufficiently strong solution of shellac in alcohol; or it may be soaked in an aqueous solution of shellac, consisting of 3 parts of common unbleached shellac and 1 part of borax boiled in 30 parts of water. Papers prepared by this latter formula have a nice pink color. Single transfer papers can be bought the same as the tissue paper, for they are made by the same manufacturers.

Development.—This operation can be conducted in full daylight, for it is essential to be able to estimate the different degrees of developing in the pictures

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* The carbon paper may be left longer in the water, even for hours, but during hot weather I would recommend to leave it for about five minutes.

Proceed as follows: Place your table, provided with hot (Summer Queen stove or other contrivance) and cold water supply, conveniently. Prepare the alum solution and filter it repeatedly, as will be explained later on. Be sure that your hot water is boiling. Now take the first of the transferred papers and place it, tissue side up, into the developing tray and pour cold water upon it. The water must stand at least one inch deep in the tray. Rock it and be watchful to remove any air-bells which may appear, for if not removed they will most likely show later as black spots in the picture. Having soaked the papers, remove them, add some hot water, rock the tray to mix the hot and cold, and reimmerse the paper, continuing to rock the tray. Around the borders of the tissue paper will appear black lines, and by and by the tissue paper will lift from the transfer paper, which indicates that the gelatine of the former is sufficiently softened to allow of its removal, and this must be done with care, withdrawing the carbon paper, holding it by one corner, with a steady motion, keeping both papers under water.

Having removed the tissue paper, there is now a black slimy mass of gelatine before your eyes. In gently rocking the tray, the water by degrees washes away all the gelatine which was not rendered insoluble by the action of the light, and the picture appears with all its contrasts, half-tones and high lights.

Should the development go on too slowly, some more hot water must be added, *always removing the print from the tray before each addition.* In case some parts of the picture should remain too dark, hot water may be locally projected upon those places, in which case its action will be mechanical.

Should water of 104 degrees F. not develop the picture, it indicates that the exposure was carried too far. In order to remedy this there are two ways, either to employ still hotter water (of say 112 to 115 degrees F.), or to add a few drops of liquor ammonia fortis. When properly managed the picture will come out all right. The development is finished when, holding it inclined, no more black particles are visible in the water which runs off. The picture is now rinsed with cold water of 60 to 70 degrees F.

If the exposure was right, and the negative not too thin, the picture on development will be very vigorous, with all desirable half-tones, but if the exposure was too short the deep shadows alone will appear, and the half-tones during development will be gradually washed away, and if the development is carried still further the entire image will disappear.

If the negative is too hard, the half-tones will disappear partially, and in such a case the only remedy is to take paper which had been sensitized two days before. This is the only recourse which the practical carbon printer has when a negative is too dense.

N.B. (1.) Never employ the same water for soaking the print which has served to develop or rinse a developed picture; always use fresh water. (2.) Over-print a little, and after soaking the prints in cold water use hot water by degrees up to 112 degrees F., and the prints will come out far more brilliant and with greater contrasts than if printed exactly to their photometric degree and developed with not such hot water. (3.) When, after soaking the print, too hot water is employed, small air-bells will form, which are rather tenacious, and unfortunately are not easy to get rid of. (4.) A good plan is to place the picture carbon side down, after removal of the tissue paper, and to allow it to develop automatically.

Failures.—The most frequent failure is the non-adherence of the tissue to the transfer paper, and during development the picture separates from the transfer paper. This is due principally to a too rich bath of bichromate, and very often happens during hot weather, the cause being that the tissue, during drying, becomes insoluble.

The strength of the sensitizing bath should be as follows:

Temperature from 68 to 76	degrees F	3 per cent.
" " 76 to 86	"	2 "
" " 86 to 92	"	1 "

Another cause of failure is the formation of many little air-bells when separating the tissue from the transfer medium. This is due to the fact, that for the first soaking of the paper too hot water had been employed. The remedy is water of a lower temperature and longer soaking. The third failure is the so-called "reticulation," of which we shall speak later on in particular. A slight alkalinity of the developing water is favorable, since the gelatine is easier dissolved; however too much (expressly added carbonate of soda or ammonia) causes reticulation or makes the image granular. Acid water develops slower, but the pictures are finer and stronger.

Alum Bath.—This bath is composed as follows for single transfer:

Finely powdered alum	3 to 5 ounces.
Water	100 "

If the water should be calcareous, which would make the solution turbid, from 3 to 5 drops of sulphuric acid must be added. For double transfer the solution should not contain more than two per cent. of alum. This solution must be filtered repeatedly before use, and as long as it keeps clean may be used over and over again; however, it is better always to use a fresh bath.

The alum bath cannot be dispensed with, for it not only hardens the gelatine, but eliminates any trace of the bichromate which might still be present, and which, if not neutralized, would impart an ugly greenish color to the picture. The developed and well-rinsed pictures are placed for from 5 to 10 minutes in the alum bath, and afterwards for at least 30 minutes in a tray containing cold water, from which they are removed, rinsed again in cold water and hung up to dry. The carbon picture when dry loses all its relief, and becomes rather resistant to any rubbing; it even requires a little pressure to attack it with a scraper.

Reticulation.—Unfortunately very often during hot weather this trouble makes its appearance. The picture on development appears to be covered all over with a fine black net-work which destroys its delicate appearance, and (holding the picture horizontally against the light) looks as if it had lost all its gloss. This defect can be produced at will by the carbon printer, for it is only necessary to immerse the carbon paper, when effecting the transfer, in water of 88 degrees F. instead of cold water. Therefore to avoid it employ water of not more than 58 degrees F., and use an ample supply in the tray, always keeping the paper under its surface. The warmer the weather the cooler must the water be for the transfer operations. The addition of salicylic acid to the sensitizing bath, as indicated on page 11, has been recommended, and generally produces a good result. Too strong sensitizing baths during warm weather also cause reticulation.

Retouching and Mounting.—The retouching of the picture is easy. It is first rubbed over with finely powdered cuttle-fish bone. The stump should be charged

with finely ground lamp-black and carmine, or, still better, *caput mortuum.* The scraper can be used to produce bright high lights. After successful retouching the picture is rubbed with a soft flannel tuft soaked in the following solution:

White wax..... 1 part.
Warm benzine..... 10 parts.

Do not use till cold. The pictures allow of being burnished and may be rubbed before or after; burnishing first and applying the wax lubricator later, gives a better result. The mounting may be done in the usual way on Bristol board, but care must be taken that the paste does not touch the picture side, for it would not be easy to wipe it off, since the carbon print when moistened becomes rather delicate. When in the right place cover it with a piece of stout paper and rub down well to insure good contact with the card-board.

CHAPTER VIII.

Double Transfer Process.

The lighting of the room, exposure of the tissue to the light, etc., are all the same as for single transfer, but as the picture comes right no reversed negatives are required. The entire process can be summarized as follows:

The exposed carbon tissue is placed in cold water; pressed on to a glass or porcelain plate, which has previously been rubbed with waxing solution; developed with warm water; passed through the alum bath; dried; again placed in cold water and pressed into contact with the double transfer paper, and, when perfectly dry, separated from the plate. This process furnishes pictures with a high gloss.

Ordinary glass plates can be used, but if really fine work is desired it is necessary to employ French glass of from 4 to 5 centimeters thick. Beginners do better to use opal glass, for, as it is white, the intensity of the print is far easier seen. It requires some practice to be able to estimate the strength of a carbon print on glass. Ground plates furnish prints which are "matt," *i.e.*, have a finely grained appearance. The carbon picture takes exactly the same character as the support employed, and special care must be used when selecting the plates, for any scratch or defect in them will show in the carbon print.

Larger sized plates offer a great advantage, for they allow of simplifying many of the operations, and it is just as easy to handle a 20 x 24 plate as a 10 x 8. Of course they require larger developing, transfer and alum trays.

Having selected a faultless plate, it is first well cleaned by means of caustic potash and some drops of liquor ammonia fortis, well dried and dusted, and then taking a small piece of flannel, which is slightly dipped into the waxing solution, made as already described, the plate is carefully rubbed all over. After 30 minutes it is laid flat on a board, and by means of a dry, clean piece of white flannel is polished. The polishing must be done with very slight pressure, in order not to rub off the wax, for if this should happen the picture would not separate from the plate. It is best not to polish new plates, but to employ them waxed alone. Be careful never to breathe on a plate while waxing or polishing. Should it be necessary to free it from the wax, rub with a piece of flannel well soaked in benzine. The plates which have been used for transfer do not require

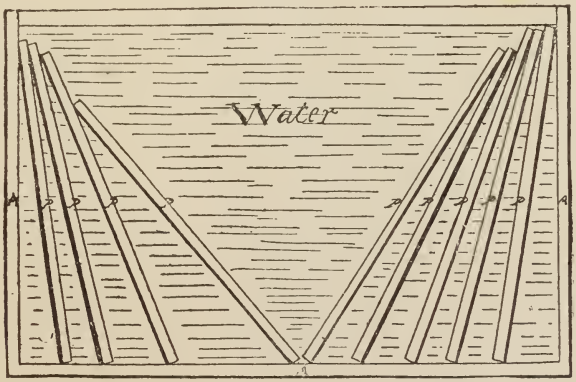
any more cleaning, the particles of collodion or tissue which remain on them can be scraped off with a flat table knife. Having waxed and polished the plates they are now left on the folding rack, being careful to protect them against dirt and dust.

Collodionizing.—This is done in the usual way, but for those who may be unfamiliar with it, the following directions should be followed. A well-dusted plate is taken, and holding it horizontally with the index, middle finger and thumb of the left hand, the collodion is poured upon it (in a steady stream and in sufficient quantity to well cover the plate) close to the left upper corner. Allow the collodion to cover this end of the plate, then incline it a little to the right side and the collodion will run to that corner. Now raise the upper part of the plate and it will run towards the end where the plate is held, and from there over to the right lower end, from which allow it to run into a second vial, which meanwhile had been taken in the right hand. A little practice will soon be acquired and not much collodion will be wasted. Plates up to 14 x 17 may be collodionized in this way. For larger plates a very convenient contrivance is a glass bottle with a cork, on which the plate is rested and directed by the left hand.

N.B. 1st. Always use filtering paper between your fingers and the plate, for if this is not done, spots frequently appear in the collodion where they have supported the plate, being due to the faster evaporation produced by the warmth of the fingers. 2d. Always pour enough collodion to fully cover the plate, for if you again had to pour on more, lines and marks would appear where the first and last pourings meet. 3d. Never pour the collodion on one place alone, for the ether might dissolve the wax on the plate and the picture would not separate.

Allow fully TWO MINUTES for each plate to get sufficiently dry, and immerse in the reservoir tray, proceeding as follows: Place the plate in an upright and slightly inclined position, collodionized side against the side of the tray, and see that it is well covered by the water; do the same with the following plates, which

FIG. 7.



A A A Tray. *P P Plates.*

The heavy lines indicate the collodionized side.

will easily be understood by a glance at the cut. Having immersed all the plates, they must remain in the water for *at least twenty-five minutes*, but no harm will ensue if they remain for hours.

N. B. 1st. Allowing less than two minutes for the setting of the collodion would produce an opalescent appearance in the lighter parts of the carbon picture or breaking of the collodion film when separating the tissue for or during development. Allowing more time makes the collodion too horny and the carbon tissue will not stick to it. 2d. Be sure that the water in the reservoir tray is perfectly clean, and protect it against any dust while the plates are in it, for that would adhere to the collodion. 3d. When withdrawing a plate from the tray it must always be washed all over with clean water, which should run off freely from the plate and thus show that no more alcohol is present in the collodion film.

First Transfer.—Having filled the tray with clean cold water (58 degrees or less), and having subdued the light, take a carbon tissue sheet, dust it well on both sides, and immerse it, carbon side up, in the water. Use the camel's hair brush to remove any adherent air-bells. Turn it over, and repeat this operation, *always keeping it under water*, for if this is not done reticulation might appear.

The carbon paper first rolls up, but after about a minute it flattens out and then rolls up again, this time with the carbon side outwards. When it begins to lay flat, take a plate from the reservoir tray, give it a good wash with clean cold water, and lay it, collodion side up, on the table or developing board. The carbon tissue is now taken by two corners and the water allowed to run off, and as soon as only drops form it is laid carefully, carbon side down, upon the collodionized plate, care being taken that no air-bells remain between them. It is a good plan to hold the carbon paper by two diagonally opposite corners, and lower it, the center or sunken part first, upon the plate, and allow the sheet to lay flat by itself. Care must be taken that it is placed well upon the plate, for the collodion film does not stand much moving to and fro of the tissue paper. Should it be necessary to remove the tissue, in order to place it more accurately, it can be done, but before replacing it upon the plate it should be placed for a moment in the cold-water tray. Being in its right place, the tissue is now covered with the rubber-cloth (cloth side in contact with it) and the squeegee is now applied, striking always from the center towards the borders and using first gentle and afterwards a little more pressure. Bear in mind that the carbon tissue should never lap over the plate, and care must be taken to cut the paper always of such dimensions that, while wet, it is not so large as the transfer plate; $\frac{1}{8}$ to $\frac{1}{4}$ inch less each way will do. Remove the rubber-cloth and examine whether the tissue is in intimate contact all over the plate. Should some places show which appear as if a little raised, this indicates that there is air between the tissue and the plate, and the rubber-cloth and squeegee must be employed again.

If the desired result is not obtained, the paper may be removed by gently drawing it with an upward motion, and being very careful not to break the collodion film. Then place the tissue paper again for one second in the cold water, carefully replace upon the glass plate, and apply the rubber-cloth and squeegee again.

If everything is found satisfactory, dry the borders of the paper and its back by means of a soft towel or sponge, being careful not to hurt the projecting collodion. The drying of back and borders of the tissue paper *must never be omitted* Proceed in the same way with all the papers and plates and lay one on top of the other.

It sometimes happens that the borders of the tissue do not adhere to the col-

lodion, and in such a case covering it with a glass plate and using pressure from a quarter to half an hour will be necessary.

Development.—Having made the transfer, fifteen minutes at least must be allowed before proceeding to the development, but an hour is better. The development may be made still later, provided the papers are covered with a glass plate to prevent them from drying. Developing sooner than ten minutes after the transfer generally causes reticulation. It is not necessary to use a plate for each tissue paper, for if there are, for instance, two pieces 5 x 8 of same exposure, they may be transferred upon a 8 x 10 plate. After acquiring a little practice in developing, no great difficulties will be met in handling plates on which two or more prints have been transferred, and which are of different impression.

As regards the development, it is good to again read over what was explained when describing the single transfer process, as the manipulations are exactly the same.

The alum bath must not be stronger than two per cent. The plates, after being immersed in it, are placed for half an hour in a tray containing clean cold water of 60 or 76 degrees F., each getting a good wash, and are then placed on the folding rack to dry, which takes about six hours. Never place the pictures face to face, nor put them in an air draught or too warm a room, or the prints might separate from the plates. The wet carbon pictures must also be carefully protected against dust, for it would be very difficult to remove any that might adhere to them.

Always use fresh water baths for each development, for if a picture is developed in the water which has been used for another, small carbon spots are likely to appear in the second one. It is rather difficult to free a picture of these small spots; applying a fine sable brush dipped in hot water sometimes succeeds, but not always.

Retouching and Spotting Out.—Should there be necessity for retouching, spotting out or darkening certain places of the picture, it must be done before the second transfer is made, for it would show too much when done after that. Retouching is done in two ways; either by means of oil colors and brushes, or with the stump and finely ground lamp-black, carmine, *caput mortuum*, or graphite. If the retouching is done with dry colors it is best to flood the carbon picture with a solution made of 1 part glycerine in 25 parts water and allow it to dry. Plates prepared in this way take the dry colors very readily.

Second Transfer.—The so-called double transfer paper is also made by the carbon paper manufacturers, and it will be found convenient to buy it. However it may be prepared as follows: 10 ounces of gelatine are dissolved in 100 ounces of water; when liquefied from 1½ to 2 ounces of glycerine are added, and while this solution is still warm, 10 ounces of saturated solution of chrome alum are added, but this must be done drop by drop and with thorough stirring. If a very fine surface is wanted, a convenient quantity of sulphate of baryta may be added. The baryta is placed upon a grinding slab and is finely incorporated while adding the gelatine solution by degrees; the chrome alum solution is added last. The covering of the paper is done by floating on or drawing it over the warm solution. Fresh double transfer paper is soluble at about 95 degrees F.; older papers require a higher temperature, and often even boiling water will not have any effect on them; in such a case the paper is useless.

The second transfer manipulations can be conducted in full daylight. The transfer papers having been cut a little smaller in size than the glass plates, are placed, after having been dusted on both sides, in a tray containing clean cold water (of 60 to 70 degrees). The tray should be well filled, and the papers should remain from 5 to 10 minutes in the water, but an immersion of even two hours would not produce any bad effects. One of the plates with the dry carbon picture upon it is now carefully dusted and immersed for *just one second* in cold clean water, placed upon the table, picture upwards, and a piece of the double transfer paper is withdrawn from its tray and immersed in a tray containing hot water (from 95 to 150 degrees or more, according to the solubility of the paper) where it has to remain until the gelatinous covering of the paper becomes slimy. It is now placed with its gelatine side downwards upon the glass plate. Being in its right place, cover with the rubber cloth T, cloth side down, and apply the squeegee, using first gentle and afterwards more pressure, and striking always from the center to the borders.

N. B. (1.) Should water of 140 degrees F. not soften the gelatine of the double transfer paper, a small lump of carbonate of soda, or a few drops of liquor ammonia fortis may be added. If one or the other of these additions does not produce the softening of the gelatine, it will be proof that the paper has become insoluble, and fresh paper must be employed. (2.) If the water is too hot, or if the double transfer paper remains too long in it, it may happen that the gelatine will be liquefied, when it must not be used. If the water was not hot enough, or the paper had not remained a sufficient time in it, it happens that the transfer paper does not adhere well to the carbon print, and in drying there will appear many brilliant spots in the picture, principally where the high lights are, and around the outlines of the deep shadows. This same defect appears also if the plate has been immersed in warm or hot instead of cold water. If the cold water remains too long upon the carbon picture its final appearance often will be granular. (3.) If, in drying, the transfer paper peels off the plate without the carbon picture, this is generally from the picture remaining too long in the alum bath, or that the water in which the transfer paper has been soaked was too warm and dissolved the gelatine. (4.) If the paper, when dry, cannot be separated from the plate, or at some places sticks to it (principally in the lighter parts of the picture), it was caused by too hard rubbing the plate when polishing the waxing solution; or that the flannel used for this operation was not dry; or that the paper, when effecting the first transfer, had been left too long before developing.

Having affected the second transfer, the plates are placed upon the folding rack, where they have to remain until fully dry, which takes place in 3 to 6 hours, according to the temperature and dryness of the air. During dry weather care must be taken not to place the plates in a strong current of air, for the unavoidable consequence would be that the papers, either partially or *in toto*, would separate from the glasses, showing an uneven gloss. When fully dry, the papers are separated from the plates by inserting the blade of a pen-knife under one of the corners. It comes off with a brilliant gloss.

In order to preserve this high gloss, when mounting the pictures on Bristol board a special method as regards the paste or glue must be followed, for if the pictures were covered on their backs with paste or glue they would lose their gloss, and afterwards show only a brilliancy like albumen prints. The carbon

pictures are trimmed to shape with large scissors; laid, with their carbon side downwards, upon a glass plate, and some strong and hot glue then applied only to the borders; they are placed in position upon the card-board, covered with a sheet of moderately stout paper, and pressed on by means of a paper-cutter, or weighted with a heavy glass plate, or some other pressure is employed. Care must be taken not to allow any glue to touch the carbon side, for it would take away the gloss from that part of the picture.

An easy way to preserve the gloss of a carbon picture is the following: Half an hour after having made the second transfer, paste upon the transfer another somewhat larger sheet of ordinary paper which had been previously damped. Turn over the borders to the back of the plate at two opposite sides and press them on. Upon this second sheet three or more others may be pasted, thus forming a card-board. The drying, of course, will take some hours longer, but the appearance of a carbon print mounted in this way is really pretty, and compensates for the trouble taken. When thoroughly dry, the picture may be separated from the plates, as indicated above, and trimmed to shape. Three or four pieces of double transfer paper may be used instead of the ordinary papers, but the second sheet should always be larger than the plate and doubled to the back and pasted on to it. This assures fast drying, and does not separate the paper from the plate before being thoroughly dry.

CHAPTER IX.

Transfer to Supports Other than Glass.

Double Transfer with Zinc Plates.—There is only a small difference between this and the former process. In place of glass or porcelain plates, zinc plates are employed, and the collodionizing may be dispensed with. The appearance of the picture depends upon the class of zinc plates used; *i.e.*, if finely polished plates are used, glossy pictures like albumen prints; if granulated plates, pictures without any gloss will result. The zinc plates should be well planed, free from any defects on one side, and of about $\frac{3}{16}$-inch thickness. New plates, or such as have not been in use for some time, are covered with a layer of oxide, which can only be removed with great trouble and which imparts a grayish color to the first few pictures developed upon them. For use they must either be treated in the same way as a glass or porcelain plates, or with the following solution:

Pure white or, preferably, yellow wax	1 part.
Rosin	1 "
Benzoline or spirits of turpentine	50 parts.

The plates after having been dusted are rubbed with a piece of soft linen or flannel dipped in the above solution. Some minutes are allowed for drying, and then they are polished in the same way as a glass plate. Only a gentle pressure must be employed whilst polishing. All the other operations as regards first transfer, developing, alum bath, and second transfer are identical with those of glass plates, only the retouching must be done after the second transfer.

Double Transfer with Flexible Supports.—The flexible supports are furnished by any dealer in carbon materials, but for those who would like to prepare them, the following information is given.

A smooth white paper of sufficient strength is immersed for from 5 to 10 minutes in a nearly saturated solution of unbleached shellac (which imparts to it a nice pink color), and is hung up to dry. The paper may also be treated with an aqueous solution of shellac prepared as follows:

Uubleached shellac	4 parts.
Powdered borax	1½ "
Boiled in water	35 "

Whilst this solution is still hot, the papers are immersed in it, one by one, for five minutes, then withdrawn and hung up to dry. If these papers are required to show a very smooth surface, they may be passed through the burnisher, which should not be too hot. Before use the flexible supports must be treated with the waxing solution, made as follows:

Pure wax	1 part.
Rosin	1 "
Benzoline (heated in a water or sand bath)	50 parts.

Or ½ part rosin and ½ part gum dammar may be substituted. The waxing is done in the same way as with zinc plates.

The flexible supports should always be a little larger than the carbon prints. Immerse the support, glossy side uppermost, in a tray containing abundant and pretty cold water. After about one minute they will flatten out. The carbon paper is also immersed in cold water, either in the same tray or a second one, freed from any air-bells, and brought into contact (under water) with the glossy side of the support; withdrawn from the tray, placed upon a glass plate or smooth board, and, applying the rubber-cloth and squeegee, pressed into intimate contact. Having withdrawn the rubber-cloth, the borders and back of the carbon paper are carefully wiped, and it is hung up to dry. Small sheets may be suspended by one wood clip, larger sheets require from two to three. After from 15 to 30 minutes the development may be made, proceeding in exactly the same way as already described. The developed picture must remain for about ten minutes in an alum bath of 2 per cent., and from there must be placed for about thirty minutes in clean cold water. Soaking a piece of double transfer paper in cold and hot water as described, it is placed upon the flexible support and squeegeed into intimate contact. Both the rubber-cloth and squeegee employed for the second transfer should always be used for this purpose only. Wipe the borders and back of the transfer paper and hang up to dry. When fully dry it may be separated in the usual way from the flexible support, which can be used repeatedly, all that is necessary being to free it from any adhering carbon or paper particles; rub with the waxing solution, and polish as indicated above. The polishing is best done with a soft linen towel. The mounting of such pictures must be done only when they are perfectly dry. They are trimmed by means of large paper scissors. The best way to mount them is to pass a brush charged with thick hot glue around the borders, and rub them on to the card-board. Paste or gum arabic may also be used, but care must be taken not to get any paste upon the picture side, the latter producing a less glossy appearance of the picture when dry.

Retouching Transferred Pictures.—Transferred prints, without the employment of collodion, can be retouched in the same way as albumen prints, the only precaution being to rub with a piece of linen dipped into benzoline or spirits of

turpentine in order to free them from greasiness Parts of the picture which would show too dark may be rubbed down with finely ground pumice-stone. High lights are produced by the scraper. The stump, charged with a mixture of equal parts of the finest lamp-black and carmine powder, may be used for the larger parts to darken them. The retouching of small spots may be done by taking a piece of carbon paper which has been dipped into hot water, and with a fine brush taking from the liquefied carbon as much as is wanted to block up the spot. In this case the retouching consists of the same material as the picture, but in order to render these spots stable, the brush must be dipped into a weak solution of chrome alum.

Burnishing and Varnishing.—Carbon pictures may be burnished in the same way as albumen prints. In employing a heated burnisher however, the pictures must be warmed before passing them through the rollers, for any trace of moisture would show itself in a rather ugly way. The varnishing is best done by using a saturated solution of wax in benzole; an alcohol varnish of medium strength or a ten per cent. solution of gum dammar in benzole may also be employed. Rubbing the pictures with cerat or ceroline imparts a nice gloss to them, preserving them effectually against any moisture.

Second Transfer of Pictures on Flexible to other Supports, as Alba or Wood Plates, Canvas, Card-board, Porcelain, etc.—The carbon picture, after having been dried upon the flexible transfer paper, may be retransferred to any plane surface, provided that it is covered with gelatine. Carbon pictures on alba plates or porcelain are of a really extraordinary beauty. The gelatine solution is prepared as follows: 20 ounces gelatine are dissolved in 400 ounces water, and just before use a solution of 1 ounce chrome alum, dissolved in 20 ounces water, is added to it drop by drop, always whilst stirring vigorously. This solution may be spread over the plate whilst still warm. A broad camel's hair brush may be used, passing it first lengthwise and afterwards crosswise over the plate. Having been so covered, and care having been used to avoid air-bells forming, the plates are allowed to dry. The transfer is effected as follows: The flexible support, as well as the gelatinized plate, are immersed in cold water and brought into contact; they are then withdrawn and the squeegee is applied with gentle pressure. When fully dry the flexible transfer is withdrawn, leaving the carbon print adhering to the plate or wood-board. For porcelain or opal plates, or mica, the proceeding is exactly the same. The transfer to card-board, or into a book or album, is made in the following way: The carbon print whilst still wet is floated upon a warm solution of 1 part gelatine in 5 parts water, and hung up to dry. Being quite dry it is again floated on a strong solution of white sugar in water and dried again. The place which the carbon picture is to occupy on the card-board or in the album is gelatinized by means of a brush and allowed to dry. The carbon picture is trimmed to the desired shape; the picture, as well as the gelatinized place, is moistened, and it is placed carefully into position, always avoiding any air-bells between the two. Light squeegeeing is applied and a light pressure is resorted to whilst drying. When fully dry, the flexible support peals off by itself. The transfer of carbon pictures upon wood plates for xylographic purposes, since an inverted image is wanted, may be done by simply effecting one transfer only and developing the picture when on the wood. The plate is covered with the above-mentioned gelatine solution and allowed to dry. The transfer is made exactly in the same manner as described

under single transfer, and development may be made after five minutes. The picture is washed in cold water, no alum bath being used, and is allowed to dry slowly without heat.

Second Transfer to Canvas for Oil Painting.—The important question to be considered here is that such an absolute and intimate contact between the canvas and the carbon is secured that a peeling off of the carbon picture is almost impossible. Canvas, as generally used by oil painters, is stretched upon a board and its surface is rubbed all over with a strong bristle brush dipped in sufficiently strong potash ley. The brush must be employed until the fiber of the canvas shows, being careful not to rub so hard as to open the spaces between the threads, which must by all means remain filled. When fully dry the canvas is covered three times with a thin gelatine solution made as follows:

Gelatine	40 ounces.
Water	400 "

to which, whilst still warm, a solution of

Chrome alum	1 ounce.
Water	20 ounces.

is added drop by drop. After each application of the gelatine the canvas is allowed to dry thoroughly. The carbon print being upon the flexible support is not allowed to dry, but while still wet is placed upon the canvas which has previously been wetted with cold water. Rubber-cloth and squeegee are applied in the usual way. After drying the support is separated from the canvas.

CHAPTER X.

Transparencies—Colored Pictures.

Transparencies on Glass.—The ease and certainty, as well as the cheapness, of this process will always induce its workers to adhere to it. The beautiful results obtained in carbon transparencies will most assuredly stand unrivaled. The tissue required for transparencies is a special one, *i.e.*, it is charged with much more coloring matter than the ordinary carbon tissue. Its sensitizing and drying is done in the same manner as already described. The exposure to the light has to last at least double the time required for paper pictures. The exposed paper is immersed in cold water and squeegeed to a well-cleaned glass plate, allowed to remain in contact for ten minutes and developed. It is then washed, passed through the alum bath, and dried. Plates with the carbon pictures upon them which are destined for the magic lantern must be pasted to clear glass plates, mounting them in the usual fashion; but those intended for transparencies are mounted with ground glass.

Coloring Carbon Pictures.—Carbon pictures developed upon collodionized plates may be colored in many ways. Since the gelatine absorbs the colors in proportion to its thickness, fluid colors as well as solutions may be used, the latter by double decomposition producing colored deposits. The coloring may serve either to change the color of the carbon print; to strengthen, or better, to intensify it. A saturated, or diluted, solution of permanganate of potash flowed over the still wet carbon print imparts to it a more or less intense olive-green tint. This color is not very pleasant to the eye, but is of great importance for

the multiplication of negatives, since it intensifies the image to a much higher degree than the eye would be able to perceive. Beautiful purple tints are obtained by the employment of purple solutions, or artificial alizarine dissolved in water, to which some addition of liquor ammonia has been made. Aniline colors may also be employed, but as they are not fast colors they should not be used on pictures which are exposed to light, as window transparencies, etc. A beautiful dark violet color is obtained by conforming to the late Dr. von Monkhoven's formula, viz., three solutions prepared as follows:

A. 4 per cent. solution,

Sulphate of peroxide of iron	40 grams.
Water	1 liter.

B. 4 per cent. solution.

Carbonate of soda, c. p	40 grams.
Water	1 liter.

C. 1 per cent. solution.

Gallic acid	10 grams.
Water	1 liter.

The carbon picture is immersed for five minutes in bath A, washed with clean cold water for a few seconds, and immersed for ten minutes in bath B, from which it is withdrawn and washed again. Holding the plate against the light it will be found to have assumed a slight reddish tint. The picture is now immersed in the third bath, C, where it is allowed to remain a longer or shorter time according to the degree of density which is desired. The print may be withdrawn from the solution for examination as often as required. A thorough washing is finally given and the plate allowed to dry. It is best not to print the paper too strong.

A dark blue-black tint is obtained by using the following solutions. Extract of logwood is dissolved in warm water, which solution when sufficiently cool is poured upon the still wet carbon picture. After this application the print is washed for a few seconds and a three per cent. solution of bichromate of potash is applied for three seconds. These solutions, in alternation, may be applied repeatedly until the desired tint is obtained.

It sometimes happens that the carbon tissue does not adhere well to the glass plates, or, during development and the following manipulations, leaves it. When this should happen it is better to proceed as follows. Instead of squeegeeing the exposed tissue to the clean glass plate, a perfectly clean French glass plate, a little larger than the intended print, is collodionized with clear collodion and allowed to dry for some hours in a place free from dust. Before applying the collodion this plate is *not* waxed; and must *not* be immersed in water, as is generally done to free the collodion from the alcohol. The carbon tissue is sensitized in the usual way, placed carbon side down upon the collodionized side of the plate, and squeegeed into intimate contact, and the plate with the sensitized tissue upon it is allowed to dry. The carbon paper prepared in this way remains sensitive and good for at least seven days, provided that the paper be covered with a glass plate to protect it from the air. If a number of plates have been prepared in this way they are laid one on top of the other, protecting the uppermost, as stated above. Careful laying of the sensitized carbon tissue is absolutely necessary, for if it once lays flat it would not be possible to withdraw it from the plate without tearing the collodion film. The drying will take about three hours.

It is better to prepare these carbon sheets of larger size than required, for the manipulations are almost the same for a large sheet as for a small one. Before use for printing, the required size of the tissue is cut from the plate, leaving the remainder in contact with the latter. Paper which has been prepared in this way shows a highly brilliant, even surface, and will lay in most absolute contact upon any negative, and as the optical contact is, so to speak, perfect, it will give much sharper and finer prints than the tissue which was dried in the free air and in the usual style. The exposure to light is affected in the same way as usual, but before developing the paper is placed in a tray containing slightly acid water (1 part muriatic acid to 1,000 water). It must remain longer than usual in the water, as it is essential that the gelatine absorb as much as possible, for without this precaution it might easily become reticulated. When well saturated the paper is placed upon a clean glass plate, and, without using the rubber-cloth, is squeegeed into contact. Should the borders not adhere the paper may be weighted down by a heavy glass plate, when, after thirty minutes, it will lay perfectly flat. The development should never be made sooner than thirty to forty minutes after the last manipulation. It is prudent to begin the development with rather lukewarm water of not over 82 degrees F., and only later on to use hotter water.

Should the collodion peel off during development, it would be better to allow two hours' time for the paper to remain in contact with the plate before development; or to collodionize or gelatinize the glass plate, or to flood the plate with a thin solution of gutta-percha in chloroform. The paper adheres splendidly to this last substratum, which must be perfectly dry before the application. Transparencies sometimes require a little intensification, but when the plates have been gelatinized the following solutions cannot be employed, since they would tint the substratum also. Transparencies on clear glass or on collodionized plates may be treated with the following solutions:

No. I.

Permanganate of potash	4 parts.
Water	1,000 "

No. II.

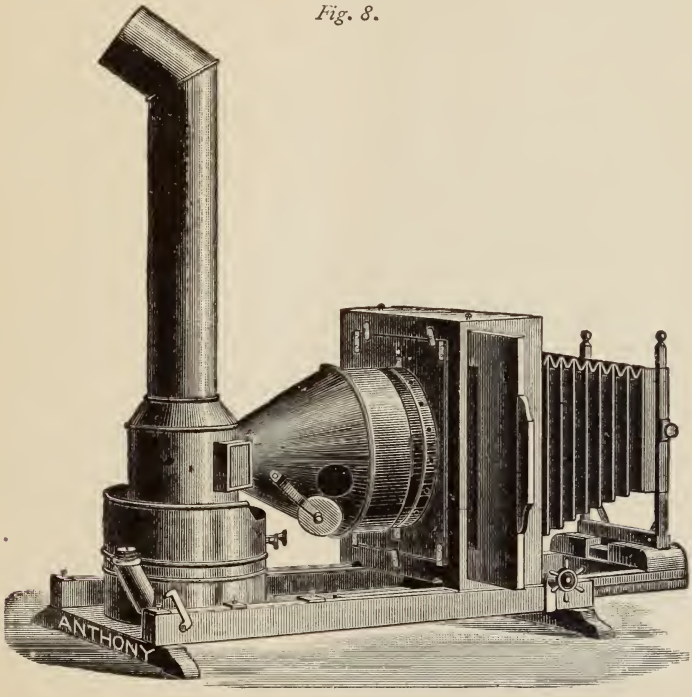
White sugar	2 parts.
Ammonia	2 "
Water	1,000 "

Equal parts of these solutions are mixed in a tray into which the transparency is immersed for some seconds. Its color becomes a yellowish tint. This way of intensification offers the advantage of only changing the actinic value of the print without producing any granular deposit upon the plate, as the intensification with logwood and other materials always do. Retouching is done with a leather or paper stump and the finest graphite powder.

Enlarging Small Negatives by Means of Artificial Light (*Petroleum or Gaslight*).—The carbon process offers many great advantages for the production of large prints by means of small negatives. The first and principal advantage is that the enlargements are stable, which, considering the high price paid for such class of work, is of great importance. Secondly, no other process allows of the production with such ease and certainty of a good and convenient transparency for enlarging as the carbon process does. And, thirdly, the results obtained are of such beauty that no other process can furnish them. Besides, it must be taken into consideration that any negative, provided that it is absolutely sharp,

may be used. The proceeding is as follows. A positive is produced in the usual way by the enlarging camera; the exposed tissue, after having been moistened, is squeegeed to a clean glass plate and developed. This positive is placed in a printing frame, and, using another sheet of sensitized carbon tissue, a negative is produced. Or the positive is placed in the copying camera and by the wet process a negative is produced, which now serves, after having been retouched, for the reproduction of as many large prints as are desired. As stated before, the transparency for enlarging requires a carbon tissue richer in color than that ordinarily used. For the successful production of a good transparency intended for enlarging, it is necessary to employ the carbon paper prepared with collodion; and furthermore, it is best to always gelatinize the plate to which the exposed tissue will be squeegeed, for then reticulation will be avoided. The gelatinizing for this purpose is best done as follows: 13 ounces of Nelson's medium gelatine

Fig. 8.



are soaked for one hour in 400 ounces of cold water, which is now warmed to produce liquefaction. When fully dissolved a solution of 1 ounce chrome alum in 160 ounces water is added by degrees, vigorously stirring the solution, which is kept warm and filtered through fine muslin. The glass plates are flooded with this warm solution in the same way as if collodion was employed. The plates so gelatinized are allowed to dry in a cool place free from any dust. The plates may thus be prepared in advance, taking care to mark each one on the back in order to know the gelatinized side. They are stored in cases of convenient size, laying the gelatinized sides face to face.

Before use these plates are carefully dusted, placed for one minute in cold water, then carbon tissue is introduced, and when it flattens out is brought into contact with the plate and, together with it, is withdrawn from the tray. The squeegee is applied in the usual way and some pressure exercised upon it. It

must remain under pressure for not less than ten minutes before it can be developed.

The *enlarging lantern* (Fig. 8) may be used with advantage. The condenser should be of from 4 to 6 inches and of double plano-convex construction. Since the enlarging is done in the dark room no camera is required, and all that is wanted is an easel or a conveniently constructed plate holder. It is easy to make such arrangements on one wall of the dark room, where it does not interfere with other work there, to fix a board on which to rest the plate holder, or a board of suitable size on which the paper may be attached by means of some tacks. The lantern is placed on a camera stand provided with casters, and placed in position before the easel. The focusing is done upon a white card, which shows much better than any ground glass. The way of inserting the transparency in the lantern determines whether a reversed or right negative will be obtained. For pictures intended to be made by the double transfer process the film side of the transparency must stand towards the condenser, for the single transfer it must stand towards the enlargement. Enlargements produced by the double transfer process have a very beautiful appearance. The retouching cannot be done upon the collodionized print when separated from the plate, but there are four opportunities to retouch them: First, in the original negative; second, on the carbon transparency; third, on the enlarged negative; and finally, on the print whilst it is still in contact with the plate. All this retouching, so to speak, is invisible. Care should be taken not to overdo the retouching; a little practice will soon teach how far it may be carried.

The photometer also comes into use for enlargements produced by a solar camera or by artificial light. It must be placed within the circle of illumination, and in order to ascertain the time of exposure required, a strip of carbon paper is exposed first and developed before undertaking the production of the enlargement. The enlarging lantern may be used with the lime light, an exposure of corresponding duration being given. From twenty to thirty minutes will be found sufficient. When a solar camera or lime light are used, the enlargement may be made direct from the small negative, thus saving the production of a positive. Some operators also use for solar printing a small carbon transparency and develop the insolated carbon enlargement on glass, while after intensification with permanganate of potash it is employed for the production of large prints.

Failures and Their Causes.

This chapter contains an enumeration of the failures to which the carbon process is subject, since the old adage, "there is nothing perfect in this world," applies unfortunately to this beautiful process just as well as to any other.

Failures.	Causes.
The black gelatine whilst sensitizing runs off in streaks.	The sensitizing bath was too warm.
The same occurs whilst drying.	The bath was too warm; squeegee the tissue plates on a glass or zinc plate and dry in cooler room.
Particles of dust or fibers of the paper adhere to the tissue after squeegeeing.	The plate was not clean, or the squeegeeing had been done without the rubber-cloth.
The tissue does not lay flat in the printing frame	The paper has been dried too fast and should be allowed to absorb a little dampness.

The tissue sticks to the negative.	The paper was not dry enough, or the negative or pad was damp. Impermeable paper or rubber-cloth should be laid between the tissue and the pad.
The wax on the plate cannot be polished.	The plate was too cold, the wax was not pure, or the polishing flannel was damp.
Small air-bells appear after laying the sensitized tissue upon the glass plate.	The paper was not a sufficient time in the cold water, or had not been lowered with enough care upon the plate. Withdraw the tissue, remoisten and replace it.
The tissue does not stick to the plate, the borders raise.	It had remained too long in the water, was over-exposed, or suffered from emanations from kitchen, gas, etc. Apply pressure for 10 to 15 minutes. A prompt way to learn if the paper is still good is to apply hot water to a small piece of unexposed tissue, if the gelatine dissolves it is still good.
The tissue in developing does not separate from the plate, or the picture does not develop, remaining too dark.	The exposure was too long, or the transfer was made too late after the exposure to light. Hotter water, or a bath of two per cent. carbonate of soda, or the addition of a few drops of liquid ammonia may be used; or the paper is not good.
The tissue lifts too quick from the plate and the picture is too light.	The exposure to light was too short. Develop with cooler water.
Air-bells appear on the back of the tissue when immersed in the developing bath.	The water was too warm. Begin with cold water and raise its temperature by degrees. The air-bells often show in the picture.
The picture lifts on the borders whilst the collodion remains.	No safe edge had been used, or the paper was spoiled. Too old, or affected by emanations from gases.
The picture, together with the collodion, lifts from the plate.	The wax contains tallow. A slight addition of rosin to the waxing solution is the remedy. The collodion had dried too much before the plate was immersed in water.
The collodion film breaks.	It is too soft or too fresh; addition of negative varnish. The film was hurt. The borders of the plates are too sharp.
Dirt or particles of paper between picture and plate.	If they were not on the plate since the beginning, they come from the water.
Air-bells between the picture and the plate or the flexible support.	The tissue was not lowered carefully upon the support, or the squeegeeing was not done in the right way.
The picture is full of small fissures.	The paper was too long in the sensitizing bath, or the bath was too strong or too warm.
The picture appears granular or reticulated.	The tissue was not left long enough in contact with the support. Paper which has suffered from emanations of gases, or dried too fast, shows these defects very often.
The picture swells up much when immersed in water, and moss-like excrescences appear in the picture.	The sensitized paper is spoiled by emanations from kitchen, stable, gas or closets.
Reticulation of picture during development on glass plates.	The exposed paper had not remained a sufficient time in cold water before affecting the transfer.

Small brilliant spots or air-bells appear in the picture.	Same reason as the preceding. They form some minutes after the transfer, and as they are between the paper and the collodion, there is no remedy.
Cloudy appearances, principally in the background of the picture.	If hotter water does not remove them then they are due to the alcohol which was still present in the collodion when making the transfer.
The picture shows no half tones.	The negative was too dense. Expose the tissue before or after printing for a few seconds to daylight; or the paper was dried too fast and consequently is too soluble.
The transferred and dry picture does not leave the support, or sticks to it in some places.	The proper flexible support or plate was not well waxed; the waxing solution contains too much rosin; the waxing was polished off entirely; or the flexible support was dried with too much heat.
The double transfer paper leaves the plate without the carbon picture.	It had been dipped in too hot water, or the alum bath was too strong.
The picture is full of brilliant spots, principally in the high lights and around the outlines.	The transfer paper was soaked in too cold water.
The picture is granular.	The second transfer was made too late.

CARBON TISSUE.

—MADE BY—

THE AUTOTYPE COMPANY, LONDON, ENGLAND.

USED IN MAKING CARBON PRINTS, TRANSPARENCIES, ETC., GIVING PERMANENT PICTURES.

NO.	COLORS.	SIZE OF BAND.		PRICE PER BAND.
100.	Standard Brown	2½ x 12 ft.	Sold in bands only.	
103.	Warm Black	" "		
104.	Engraving Black	" "		
105.	Sepia	" "		
106.	Red Chalk	" "		
113.	Portrait Brown	" "		....$2.75
115.	Lambertype Purple (for Portraits)	" "		
151.	Sea Green	" "		
152.	Dark Blue	" "		
	Warm Sepia	" "		
107.	Special Transparency Black	2 x 12 ft.		3.60
108.	Single Transfer, Med. Thick	2½ x 12 ft.		1.20
79.	" " Fine, Thin	" "		1.50

DOUBLE TRANSFER FINAL SUPPORT.

86.	Medium Thickness, 2½ x 12 ft.	$1.30
87.	Fine, Thin, for Small Work, " "	1.50
Sawyer's Temporary Support, sheets 18 x 23 in., per sheet		.35
" " " " " " dozen		3.80
" " " " 36 x 48 in., per sheet		1.30
Waxing Compound, per cake		.25
Johnson's Actinometer, with Sensitive Paper		1.10
Sawyer's " " " "		2.20
Burton's " " " "		2.75

THE TEMPORARY SUPPORT, upon which are treated pigment prints from ordinary negatives, permits of the prints being developed upon it with the same ease and facility as did the Single Transfer, of which this takes the place. This support can be used an indefinite number of times, only requiring to be rubbed over with the Waxing Solution to insure the stripping of the print from its surface.

THE FINAL SUPPORT is a special paper coated with a gelatinous emulsion of a permanent white or tinted pigment. It supersedes the old Double Transfer Paper by reason of its greater efficiency and the ease and simplicity of working with it. It will keep good for an indefinite time, does not require hot water, and forms a permanent basis for the pigment print.

ETCHING PAPER—Single Transfer. A rough-surfaced toned Etching Paper for Single Transfer, yielding prints with broad artistic effect, and free from the glaze of an ordinary carbon print. By masking the negative, prints may be developed on this paper with suitable margin, rendering mounting unnecessary.

Band 2½ x 12 feet..... $1.60

CELLULOID IN SHEETS—White. 20 x 50 inches, $\frac{10}{1000}$ in. thick, per sheet, $1.25

" 20 x 50 " $\frac{20}{1000}$ in. " " " 2.00

Sold only in full sheets.

CUT SIZES.

Sepia. TRANSFER PAPER.

	No. 86 Dble. Transfer.	No. 108 Single Transfer.
$0.25	$0.15	$0.10
.50	.25	.20
.65	.35	.30
1.00	.45	.40